Serial No.: 10/535,310
Attorney's Docket No.: 28955.1049

REMARKS

Claims 1-3, 5, 6, 8, 10, 13-15 and 17-20, as amended, remain herein. Claims 4, 12 and 16 have been cancelled without prejudice. Claims 1, 13-15, 17 and 18 have been amended. New claims 19 and 20 have been added. Support for the amendments and the new claims may be found throughout the specification (see, e.g, original claims).

1. Claims 1, 2, 5, 6, 8, 10, 12-15 and 17 were rejected under 35 U.S.C. § 112, first paragraph. Claim 1, as amended, is consistent in scope with applicants' disclosure thus mooting this rejection.

2. Claims 17 and 18 were rejected under 35 U.S.C. § 112, second paragraph. Claims 17 and 18 have been amended thereby mooting this rejection.

3. Claims 1, 2, 5, 6, 10, 15 and 17 were rejected under 35 U.S.C. § 103(a) over Hosokawa et al. JP 2000-068057 as evidenced by Hosokawa et al. US Patent 5,536,949. Claim 1 has been amended to include the limitations of claim 12 which is not subject to this rejection. Applicants respectfully request reconsideration and withdrawal of this rejection.

4. Claims 1-6, 8, 10 and 15-18 were rejected under 35 U.S.C. § 103(a) over Sakai et al. US Patent 6,224,966. Claim 1 has been amended to include the limitations of claim 12 which is not subject to this rejection. Applicants respectfully request reconsideration and withdrawal of this rejection.

5. Claims 12-14 were rejected under 35 U.S.C. § 103(a) over Hosokawa et al. JP 2000-068057 in view of Mishima et al. US Patent Application Publication 2002/0096995.

Applicants' claim 1 recites an organic electroluminescence element comprising: an anode; a first emitting layer comprising at least a first host material and a first dopant; a second emitting layer comprising at least a second host material and a second dopant; an electron injecting layer; and a cathode in the order mentioned, wherein the energy gap $E_{gh}1$ of the first host material, the energy gap $E_{gd}1$ of the first dopant, the energy gap $E_{gh}2$ of the second host material, and the energy gap $E_{gd}2$ of the second dopant satisfy the following formulas [i] to [iv]; the luminescent intensity I1 at the maximum luminescent wavelength of an emission spectrum derived from the first emitting layer, and the luminescent intensity I2 at the maximum luminescent wavelength of an emission spectrum derived from the second emitting layer satisfy the following formula [v]; and the electron mobility of the electron injecting layer is 10^{-4} $cm^2/(V \cdot sec)$ or more:

$E_{gh}1 > E_{gd}1$ [i]

$E_{gh}2 > E_{gd}2$ [ii]

$E_{gd}1 > E_{gd}2$ [iii]

$E_{gd}1 > 2.7$ eV [iv]

$I1 > 3.5 \times I2$ [v]

The Office Action admits that Hosokawa is silent on the electron mobility of the electron injecting layer. Hosokawa also says nothing about applicants' claimed energy gap relationship between the first dopant and the second dopant. Hosokawa is concerned with increasing durability and color stability by including multiple luminous layers (See Hosokawa at paragraph

[0015]). Unlike the present invention, Hosokawa does not attempt to minimize light emission from one light emitting layer and maximize light emission from another. On the other hand, the present application attempts to maximize light emission from the first emission layer and minimize light emission from the second emission layer:

> In order to solve the problems, the present inventors have found out that in an organic EL element having at least two emitting layers, the light emission of the second emitting layer is restrained or the two emitting layers satisfy a given relationship, whereby the color purity and/or durability of the element can be improved.

Applicants' specification at page 6, lines 9-14 (emphasis added here).

> As shown in FIG. 2, in the present invention, an emitting layer is made into a bi-layered structure and the different emitting layers 3 and 4 are doped with the first dopant and the second dopant, respectively, the first emitting layer 3 containing the dopant with a large energy gap mainly emitting light.
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> In general, when two kinds of dopants are incorporated into a single emitting layer, energy shift is easily caused since the distance between these dopants is small. Usually, therefore, each of the two kinds of dopants emits light or only the dopant having a smaller energy gap emits light. It is very difficult to cause only the dopant having a larger energy gap to emit light.
>
> However, as understood from the conventional art, only by making an emitting layer into a bi-layered structure, both of the first emitting layer 3 and the second emitting layer 4 emit light. Therefore light with a narrow band leading to a high purity of color is not obtained.

Applicants' specification at page 11, line 25 to page 12, line 13 (emphasis added here).

> Furthermore, in the present invention, an electron injecting layer is formed between the second emitting layer 4 and the cathode 5. The electron mobility of this electron injecting layer is preferably 10^{-4} $cm^2/V \cdot$ second or more in an electric field having an electric field intensity (E) of 1×10^5 to 10^6 V/cm.
>
> The electron injecting layer having such an electron mobility enables the more stable formation of a light emitting region in the first emitting layer 3. Accordingly, the first emitting layer 3 can emit light more selectively, so that narrow band luminescence better in color purity can be obtained. Additionally, the durability of the EL element can be made remarkably long.

Applicants' specification at page 13, lines 6-18.

When the energy gap relationship between the first dopant and the second dopant is satisfied, the second dopant acts as a carrier-trap to decrease or adjust the amount of carriers injected from the second emitting layer to the first emitting layer.

In addition, Hosokawa does not disclose an electron injecting layer having an electron mobility of 10^{-4} $cm^2/(V \cdot sec)$ or more. This claim element is not obvious. Indeed, it achieves superior color purity and durability. A person of ordinary skill in the art would not be motivated to use the electron injecting material of Mishima in the electroluminescence device of Hosokawa. Indeed, when the electron injecting layer has high electron mobility, the electron-hole recombination site shifts to the anode side and causes deterioration of hole transporting materials located in the anode side of the light emitting layer. On the other hand, in the present invention, the carrier trapping effect of the second dopant prevents such deterioration.

Evidence rebutting an obviousness rejection includes evidence that the claimed invention yields unexpectedly improved properties or properties not present in the prior art. In re Dillon, 919 F.2d 688, 692-93 (Fed. Cir. 1990); MPEP § 2145. In this case, by adjusting the energy gap relationship between the first dopant and the second dopant, and using an electron injecting layer having high electron mobility, applicants achieve unexpectedly superior color purity and durability. Compare applicants' Example 5 with Comparative Example 6 which both use an electron injecting layer having high electron mobility, namely ETM-020 (4×10^{-4} $cm^2/(V \cdot sec)$). Applicants' Example 5 achieves a half life of 8,000 hours while Comparative Example 6 achieves a half life of 1,500 hours. See Table 1 at page 81 of applicants' specification

For the foregoing reasons, Hosokawa and Mishima do not disclose all elements of applicants' claimed invention, and further disclose nothing that would have suggested applicants' claimed invention to one of ordinary skill in the art. Furthermore, there is no disclosure or teaching in any of Hosokawa, Mishima, or anything else in this record, that would have suggested the desirability of modifying any portions thereof effectively to anticipate or suggest applicants' presently claimed invention or its attendant advantages. Applicants respectfully request reconsideration and withdrawal of this rejection.

Accordingly, this application is now fully in condition for allowance and a notice to that effect is respectfully requested. The PTO is hereby authorized to charge/credit any fee deficiencies or overpayments to Deposit Account No. 19-4293. If further amendments would place this application in even better condition for issue, the Examiner is invited to call applicants' undersigned attorney at the number listed below.

Respectfully submitted,

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